ABSTRACT TEMPLATE

Title .....Dr. **Family Name** ...TREUHAFT

Given Name ...Robert.....

Institution ...Jet Propulsion Laboratory, California Institute of Technology

Address ...4800 Oak Grove Drive, MS 138-212.....

.....

Country .....U.S.A..... **Post Code** 91109 **Phone No.** 818-354-6216..

Fax No. ...818-393-5115... **Email Address** rnt@radar-sci.jpl.nasa.gov..

Presentation Preference: **Oral** ...√.... **Interactive (poster)** .....

Preferred topic number ...D9..

Abstract title: The Quantitative Fusion of Microwave and Optical Data for Forest Remote Sensing

Name of author(s): Robert N. TREUHAFT, Gregory P. ASNER, and Beverly E. LAW

Corresponding author: Robert N. Treuhaft

Abstract: One of the principal objectives of forest remote sensing is determining the component of the global carbon budget affected by forest biomass sequestration and change [Waring and Running 1998]. Forest structure and composition are key indicators of aboveground biomass and biomass change due to land use. Their measurement therefore enables global monitoring of changes in the carbon budget. Forests are sufficiently complicated targets that a single remote-sensing technique is typically incapable of accurately characterizing structure and composition attributes needed to determine biomass and carbon flux. This paper shows the first remotely-sensed determination of leaf-area-density (LAD), which is an indicator of biomass density and the carbon budget. This determination derives from *microwave radar* and *optical hyperspectral* data. Parameters such as vertical vegetation density profile and leaf area index (which lead to LAD) are estimated from the remote sensing data via physical-model-driven parameter estimation techniques. Additional parameters include tree height, and green, nonphotosynthetic-vegetation, and bare-soil fractional cover [Lobell et al. 2001]. The physical-model approach in this paper, based on discrete-scattering (microwave) [Treuhaft et al. 2000] and radiative transport (optical hyperspectral) [Asner,

1998] is largely independent of *in situ* measurements and will therefore enable global remote sensing. This paper schematically shows the methods for quantitative parameter estimation from combined data types. It also shows the LAD derived from AIRSAR and AVIRIS measurements of three forest stands in Central Oregon. These three stands have structures similar to those in logged and "natural" forests [Law et al. 2001; Law et al. 2001a], and this paper shows that combining microwave and optical data is essential to discriminating between the LAD's, and therefore the carbon budgets associated with each stand.

Asner, G.P. 1998. Biophysical and biochemical sources of variability in canopy reflectance. Rem. Sens. Env. 64:234-253.

Law, B.E., A. Cescatti, D.D. Baldocchi. 2001. Leaf area distribution and radiative transfer in open-canopy forests: Implications to mass and energy exchange. Tree Physiol. (in press).

Law, B.E., P. Thornton, J. Irvine, S. Van Tuyl, P. Anthoni. 2001a. Carbon storage and fluxes in ponderosa pine forests at different developmental stages. Global Change Biology (in review).

Lobell, D., G. Asner, B. Law, and R. Treuhaft. 2001. Sub-pixel canopy cover estimation of coniferous forest using SWIR imaging spectrometry. Journal of Geophysical Research. In press.

Treuhaft, R. N. and P. R. Siqueira. 2000. Vertical structure of vegetated land surfaces from interferometric and polarimetric radar. Radio Science 35:141-177.

Waring, R. H. and S. W. Running 1998. Forest ecosystems, analysis at multiple scales. Academic Press, San Diego.